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The Influence of Music Tempo and Lyrics on Decision Making

Senior Research Thesis

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Abstract

Previous research on the influence of music, working memory, and decision making has been somewhat contradictory, with results showing both a relationship and no relationship between these factors. This study sought to examine the influence of two specific elements of music, the lyrics and tempo, on concurrent decision making task performance. Participants were 142 undergraduate students (95 female, mean age 18.69) who were randomly assigned to one of eight working memory load conditions while concurrently completing decision making measures. The eight conditions included identical songs in a rock beat with and without lyrics, as well as the same in a mid-tempo beat. Additionally, a classical condition, a spoken word condition, a no music/silence condition, and a working memory task that was performed while also completing the decision making measures were included as manipulations. Results indicated, contrary to expectation, that those in the mid-tempo conditions made riskier decisions than those in the rock music conditions. In addition, those in the lyric conditions made more advantageous decisions than those in the instrumental conditions. Finally, those in the working memory condition made more advantageous decisions than those in all the music conditions combined. Implications for research involving working memory and decision making are discussed.

We listen to music every day. We engage in many activities while listening to music—driving, studying, reading, and completing chores. But could music have a negative effect on our lives? Could music interfere with cognitive abilities, such as decision making? If so, is this because of the rhythm of the music or the presence of lyrics? The present study sought to answer these questions.

Decision Making

Decision making is an executive function—a higher-order cognitive ability associated with frontal lobe functioning (Lezak, Howieson, & Loring, 2004). Decision making, at its most basic, involves a decision between two or more options. There are two main types of decision making: “hot” and “cold.” “Hot” decision making refers to emotional, intuitive decisions, while “cold” decision making refers to rational deliberation (Séguin, Arseneault, & Tremblay, 2007). Both types of decision making have been linked with frontal lobe functioning (Kennerley, Dahmubed, Lara, & Wallis, 2009). Specifically, the ventromedial prefrontal cortex has been associated with decision making, most notably hot decision making (Bechara, Damasio, Damasio, & Tranel, 1997).

To further pinpoint the locations in the brain of hot and cold decision making, a functional magnetic resonance imaging (fMRI) study examined the emotional and rational processes of decision making (De Martino, Kumaran, Seymour, & Dolan, 2006). Participants were informed that they had been given a specific amount of money, and then were told one of two things: that they could either keep a portion of that money or gamble it all (gain condition), or that they would lose a portion of that money or could gamble it all (loss condition). Increased activation in the amygdala, a brain region associated with emotional processing, was found when participants chose to keep the money (in gain conditions) and gamble (in loss conditions) (De

Martino et al., 2006). In addition, increased activation in the anterior cingulate cortex and the bilateral dorsolateral prefrontal cortex were found when participants chose to gamble (in gain conditions) and keep the money (in loss conditions). Collectively, these results indicate increased activation in the amygdala for risk aversion and increased activation in the anterior cingulate and bilateral dorsolateral prefrontal cortex for risk seeking. Although not specifically intended to assess hot and cold decision making processes, these results could provide further evidence of other frontal lobe regions involved in emotion-based decision making.

Working Memory

Working memory refers to the ability to hold information in short-term memory and manipulate it in some way (such as to solve a mental arithmetic task) (Lezak et al., 2004). This ability allows humans to comprehend the world around them and to acquire and retain new information and knowledge. Control and regulation of working memory, and in particular the ability to shift attention and mentally manipulate data, is also an executive function (Baddley & Logie, 1999). Regions in the frontal and temporal lobes of the brain have been implicated in working memory tasks. These regions include the inferior, middle, and superior frontal gyri, frontal pole, and left hippocampus (Uncapher & Rugg, 2005; Uncapher & Rugg, 2008; Fakhri, Sikaroodi, Maleki, Ghanaati, & Oghabian, 2013). Both decision making and working memory are executive functions, and both functions originate within the frontal cortex of the brain. It stands to reason, then, that one function could conceivably interfere with the other.

If an individual is utilizing similar parts of the brain for different tasks completed at the same time, such as by multi- or dual-tasking, it is likely that performance on one or both tasks could be impaired (Dromey & Shim, 2008). In fact, previous research has shown that completing a working memory task while also performing a decision making task impaired performance on

the decision making task (Starcke, Pawlikowski, Wolf, Altsotter-Gleich, & Brand, 2011).

Passive listening to irrelevant speech (i.e., participants were instructed not to pay attention to the speech) still impaired performance on a secondary working memory task (Alley & Greene, 2008). However, a separate study found that telling participants to concentrate less on a working memory task in turn improved performance (Olivers & Nieuwenhuis, 2006). Collectively, these studies indicate that completing multiple tasks simultaneously can affect task performance, but it is unclear if this is in a positive or negative direction.

Music, Working Memory, and Decision Making

A separate line of research has specifically utilized music as a distractor (or dual task), yielding varying results. Improvements in processing speed and accuracy were found when classical music was actively listened to (i.e., paying specific attention to the music or some element thereof) while concurrently performing linguistic and spatial processing tasks (Angel, Polzella, & Elvers, 2010). However, other research has shown impaired working memory task performance when music, either instrumental or with lyrics, is passively listened to (i.e., played in the background with no attention paid to it) (Salame & Baddeley, 1989). A more recent study found that music with lyrics caused more impairment in working memory than instrumental music or spoken word, using a counterbalanced repeated measures procedure of four conditions (silence, instrumental music, music with lyrics and speech) (Alley & Green, 2008).

Recently, a study was conducted to examine whether actively listening to music would strain working memory resources, in turn impairing decision making (Evano, 2013). This study was based on correlational research showing a strong relationship between working memory abilities and decision making (Toplak, Sorege, Benoit, West, & Stanovich, 2010). The study findings indicated that passively listening to music (either rock or classical) made no difference

on two measures of decision making, but actually improved performance on a third measure of decision making, in comparison to a no music condition. In addition, actively listening to rock music resulted in riskier performance on one of three decision making tasks compared to individuals actively listening to classical music (Evano, 2013). Of note, all decision making tasks in this study were considered hot decision making tasks. One limitation of this study was that music tempo was confounded with the presence of lyrics: the rock music was both faster and had lyrics, while the classical music was slower and had no lyrics. Therefore, it is unclear if the results were due to the music rhythm or the presence of the lyrics. A second limitation was the extreme differences between music conditions. It is possible that there is something unique about rock music that interferes with decision making, whereas more moderate tempo music may not be as impairing.

Silverman (2010) examined the influence to memory of digits sung in a female alto voice in either: a specific pitch, a specific rhythm, or both. In addition, familiar and unfamiliar children's songs were both utilized. Results indicated performance was most accurate in the specific rhythm conditions and least accurate in the other two conditions, with no main effects on familiarity. Thus, rhythm may help facilitate recall of information. In a separate study, Pring and Walker (1994) found that familiar nursery rhymes played without the words normally associated with them still impaired recall on a working memory task. This finding suggests that it is not the presence of the lyrics themselves, but instead the knowledge of the lyrics that affects working memory resources. Taken together, these findings suggest that the rhythm of the music and the presence of lyrics (or familiar-enough songs) can negatively affect performance on a secondary task.

The Present Study

The present study sought to examine what components of music affect performance on decision making tasks. Music with and without lyrics, as well as at different tempos, were compared. In addition, two spoken word conditions were utilized to examine further whether the presence of music or words affects decision making. Participants were asked to actively listen to the music condition, as active listening tasks can manipulate working memory load (Berti & Schröger, 2003). It is thought that listening to music with lyrics may tax working memory resources in the phonological loop (Baddley & Logie, 1999), in turn, taking away resources needed for optimal decision making. Based in part on the Evano (2013) study, it was hypothesized that individuals listening to rock music would exhibit riskier performance on computerized decision making tasks than individuals listening to mid-tempo music. It was further hypothesized that individuals listening to music with lyrics would exhibit riskier performance on computerized decision making tasks than individuals listening to similar but instrumental music. Finally, it was hypothesized that individuals who complete a working memory task during a decision making task (dual task) would exhibit worse decision making performance than individuals in the other conditions combined.

Method

Participants

Participants were 142 undergraduate students (47 male) enrolled in psychology courses at a regional campus of a large Midwestern university who volunteered to take part in the study for course credit. Ages ranged from 18 to 29 ($M = 18.69$, $SD = 1.47$), and 61% self-identified as Caucasian.

Measures

Questionnaires. A demographic and background information questionnaire was administered (Appendix A). This study-specific form asked participants to indicate demographic and other background information, including information about family of origin, history of diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD) or Learning Disorder (LD), history of head injury, and current and past substance use.

A study-specific music history questionnaire was also administered (Appendix B). This form asked participants to describe their history of music lessons, knowledge of music theory, and current musical preferences.

Current mood was assessed with the Positive and Negative Affect Schedule (PANAS), a 20-item self-report measure assessing levels of both positive (e.g., enthusiasm, alertness) and negative (e.g., anger, nervousness) affect (Watson, Clark, & Tellegen, 1988; Appendix C). Current mood was assessed to ensure no effect on results. The present study utilized the version of PANAS that has participants rate their affect in the present moment. Eight-week test-retest reliability is moderate ($r = .45 - .54$) (Watson et al., 1988).

Measures of Decision Making. The Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson 1994; Bechara, 2008) is a computerized task measuring risky decision making. Participants are given 100 trials in which to select from four decks of cards (A, B, C, D). They are given very little information at the start of the task, other than that they will always win money but will sometimes also lose money. The goal is to find the decks with the highest rewards and lowest penalties to either make money or lose as little money as possible. Decks A and B yield large immediate rewards but long-term negative outcomes. Decks C and D yield smaller immediate rewards but long-term positive outcomes (Bechara, 2008). In addition, selections from Decks A and C result in losses on 50% of trials whereas selections from Decks B

and D result in losses on only 10% of trials. In general, a greater number of choices from Decks A or B indicates riskier choices (Bechara et al., 1997). Although the IGT was shown to have elements of both emotional and reasoned decision making within it (Brand et al., 2007), the study of its construct validity has shown it to be a hot decision making measure (Buelow & Suhr, 2009).

The Balloon Analogue Risk Task (BART; Lejuez et al., 2002) also measures decision making and risk taking. The task is a computer simulated balloon and pump with a button labeled “collect money.” Participants are told to pump up the balloon to earn money. For each click of the mouse, the balloon blows up and participant earns \$0.05 in a temporary bank. However, if the balloon breaks (which happens at random intervals) participants will lose all money from the temporary bank. Pushing the “collect money” button before the balloon pops moves the money earned into the “total earned” space, saves it, and starts the next trial. Thus, increased risk taking is seen by a higher number of pumps and more explosions across the 30 balloon trials. An average score is calculated based on the trials in which the balloon did not pop (Hunt, Hopko, Bare, Lejuez, & Robinson, 2005). With no discernible logic as to when the balloon will pop, this task relies on affect rather than reason (Lauriola, Panno, Levin, & Lejuez, 2013), classifying it as a hot decision making measure.

The Game of Dice (GDT) is another decision making task that has explicit rules and probabilities for gains and losses (Brand, Recknor, Grabenhorst, & Bechara, 2007). Participants are given 18 throws of a single virtual die and told to guess which number will be thrown next. They are able choose a single number, risking \$1000 per roll, or a combination of 2 (risking \$500), 3 (risking \$250), or 4 (risking \$100) numbers with the probability of winning on the single number lower than probability of the other combinations. Choices of one or two numbers

are considered disadvantageous and indicate riskier behavior. Participants win if the number landed on includes the combination of the numbers chosen. The GDT strongly correlates with the later trials of the IGT (Brand et al., 2007), which classifies this as a hot decision making measure.

Additional Measures of Cognition. The Word Reading Task from the Wide Range Achievement Test-IV (WRAT) was administered to ensure consistency in baseline cognitive ability across groups (Wilkinson & Robertson, 2006). Participants are asked to pronounce a series of words, with the total number correct serving as the outcome variable. Higher scores indicate higher cognitive functioning. Performance on this task is highly correlated with performance on other word reading tasks and with performance on more complex intelligence tests (Wilkinson & Robertson, 2006).

The Digit Span subtest from the Wechsler Adult Intelligence Scale-IV (WAIS-IV) was also administered to estimate premorbid working memory ability (Wechsler, 2008). There are three parts to this task. On the first (Forwards), participants listen to an increasing longer series of digits and repeat them back in the same order, measuring basic attention span. On the Backwards condition, participants instead repeat back the digits in the reverse order. Finally, participants are asked to repeat back digits in numerical order on Sequencing. Digits were presented at a rate of approximately one per second on each trial. Digit Span Backwards and Sequencing both assess working memory capacity. Performance on each subtest was assessed by the number correctly repeated back, with higher scores indicating higher working memory ability.

The Letter-Number Sequencing subtest from the WAIS-IV was administered as part of the Working Memory condition (Wechsler, 2008). This task is similar to Digit Span, except with

letters and numbers. Participants repeat back increasingly longer sets of numbers and letters, with the numbers first (in numerical order) followed by the letters in alphabetical order.

Procedure

The study was approved by the University's Institutional Review Board. At the start of each study session, participants provided written informed consent. Next, the demographic and music history questionnaires and PANAS were administered. The Word Reading Task and Digit Span were then administered prior to the study manipulation to assess for between-group differences in premorbid cognitive abilities.

Prior to arrival at the study session, participants were randomly assigned to one of eight working memory manipulations: 1) instrumental rock music (Apocalyptica: *Enter Sandman*, *Master of Puppets*, *Harvester of Sorrow*, *The Unforgiven*, *Sad but True*, *Creeping Death*, *Wherever I May Roam*, *Welcome Home*); 2) rock music with lyrics (Metallica, same selections as Apocalyptica); 3) instrumental mid-tempo music (Gershwin: *I Got Rhythm*, *Someone to Watch Over Me*, *Shall We Dance*, *Embraceable You*, *S'Wonderful*, *They Can't Take That Away From Me*); 4) mid-tempo music with lyrics (Gershwin); 5) pod cast (a science report); 6) classical music (Vivaldi: *The Four Seasons Suite*); 7) no music; or 8) working memory (completion of Digit Span and Letter-Number Sequencing during decision making). Of note, the musical selections in Conditions 1 and 2 (rock) and Conditions 3 and 4 (mid-tempo) were the same songs, either with or without lyrics. Participants in the active music conditions (instrumental) were asked to count the number of tempo changes in each song. Participants in the active music conditions (lyrics) were asked to keep track of the occurrence of a particular lyric in each song. Participants in the pod cast condition were asked to summarize the material at the end of the study. Of note, participants were not allowed to write down anything during these tasks, meaning

that they had to mentally keep track of the number of lyrics/tempo changes or content of the science report (in turn taxing working memory resources).

Participants completed the IGT, BART, and GDT in a counterbalanced order while also completing the study manipulation outlined above. At the end of the study, a second administration of the PANAS was conducted, and participants were debriefed and course credit assigned.

Data Analysis

First, data were analyzed to see if demographic variables, estimated intelligence, and premorbid working memory ability were consistent across groups. To test the first hypothesis, independent-samples *t*-tests were conducted comparing the combined rock groups to the combined mid-tempo groups. To test the second hypothesis, a second set of independent-samples *t*-tests were conducted comparing the combined lyric groups to the combined instrumental groups. Finally, independent-samples *t*-tests and one-way ANOVAs were conducted to compare the combined data for all of the music groups to the working memory group. For each set of analyses, performances on the IGT (percent selections from each deck on early [1-40] and later [41-100] trials), BART (number of adjusted pumps), and GDT (total money earned, number of selections of 1, 2, 3, or 4 options) were examined.

Results

All study variable means and standard deviations are presented in Table 1.

Group Comparisons on Demographic and Pre-Manipulation Factors

First, the groups were assessed for differences in pre-manipulation mood, cognitive ability, music history, and working memory skills. There were no differences in gender, $\chi^2(N = 109) = 8.64, p = .28$; age, $F(7,81) = 1.11, p = .37$; or history of music lessons, $F(7,132) =$

1.01, $p = .43$. No differences emerged between groups in terms of score on the WRAT-IV, $F(7,127) = 0.49$, $p = .84$; Digit Span Forwards, $F(7,126) = 1.36$, $p = .23$, Backwards, $F(7,126) = 0.32$, $p = .94$, or Sequencing, $F(7,126) = 0.612$, $p = .745$; or current positive, $F(7,107) = 0.94$, $p = .48$, or negative, $F(7,107) = 0.81$, $p = .58$, mood. There were no significant correlations between history of music lessons and the dependent variables ($ps > .07$).

Comparing Rock Music and Mid-Tempo Music

First, the two rock music conditions (instrumental, lyrics) and the two mid-tempo music conditions (instrumental, lyrics) were collapsed into two groups (rock music, mid-tempo music) to assess the first hypothesis (see Table 2). On the decision making under ambiguity trials on the IGT (the first 40 trials), there were no group differences in selections from Deck A, $t(67) = -0.17$, $p = .86$; Deck B, $t(67) = 0.21$, $p = .84$; Deck C, $t(67) = 0.89$, $p = .38$; or Deck D, $t(67) = -0.87$, $p = .39$. On the later trials (decision making under risk), there were again no group differences in selections from any of the decks (A: $t(67) = 0.52$, $p = .60$; B: $t(67) = 1.65$, $p = .10$; C: $t(67) = 0.25$, $p = .80$; D: $t(67) = -1.51$, $p = .14$). In addition, no significant between-groups differences were found in the number of pumps on the BART, $t(69) = 0.18$, $p = .86$. On the GDT, there were no differences in total money earned, $t(55) = 0.01$, $p = .99$; however, the mid-tempo group ($M = 4.92$, $SD = 3.30$) chose two dice, a disadvantageous decision, more often than the rock group ($M = 3.10$, $SD = 1.87$), $t(55) = 2.63$, $p = .01$. No other dice selections were significantly different between the groups ($ps > .12$).

Comparing Instrumental Music and Music with Lyrics

The three instrumental conditions (rock, mid-tempo, classical) and the two lyric conditions (rock, mid-tempo) were collapsed into two groups (instrumental, lyrics) to assess the second hypothesis (see Table 3). On the decision making under ambiguity trials on the IGT (the

first 40 trials), there were no group differences in selections from Deck A, $t(83) = 0.10, p = .92$; Deck B, $t(83) = 0.32, p = .75$; or Deck D, $t(83) = 1.49, p = .14$. However, individuals in the lyrics group ($M = 25.24, SD = 9.14$) chose significantly more from Deck C in the early trials than did individuals in the instrumental group ($M = 21.44, SD = 5.24$), $t(83) = -2.45, p = .02$. On the later trials, there were no group differences in selections from any of the decks (A: $t(83) = -0.90, p = .37$; B: $t(83) = -1.38, p = .17$; C: $t(83) = -0.05, p = .96$; D: $t(83) = 1.48, p = .14$). In addition, no significant between-groups differences were found in the number of pumps on the BART, $t(85) = 0.15, p = .88$. On the GDT, there were no differences in total money earned, $t(62) = 1.33, p = .19$. In addition, there were no differences between groups in number of options selected (1 option: $t(62) = -1.08, p = .28$; 2 options: $t(62) = 0.15, p = .88$; 3 options: $t(62) = 0.92, p = .36$; 4 options: $t(62) = 0.25, p = .81$).

Comparing Working Memory to the Other Conditions

Finally, to compare the working memory condition to the other music conditions, individuals in the rock (instrumental and lyrics), mid-tempo (instrumental and lyrics), and classical conditions were combined into one group (see Table 4). A significant effect in the early IGT trials was found. Specifically, the working memory group ($M = 17.50, SD = 8.60$) chose significantly less from Deck A, a disadvantageous deck, than did the music group ($M = 21.75, SD = 6.21$), $t(97) = 2.24, p = .03$. In addition, the working memory group ($M = 30.54, SD = 21.01$) chose significantly more from Deck C, an advantageous deck, than did the music group ($M = 22.82, SD = 7.11$), $t(97) = -2.64, p = .01$. No other differences were found for the early trials ($ps > .48$). In addition, no group differences were found on the later IGT trials (A: $t(97) = 1.50, p = .14$; B: $t(97) = 0.59, p = .56$; C: $t(97) = -1.75, p = .08$; D: $t(97) = -0.20, p = .84$). In addition, no between-group differences were seen on the BART, $t(100) = 0.66,$

$p = .51$; the GDT total earned, $t(69) = 0.19$, $p = .85$; or the selections on the GDT (1 option: $t(69) = 0.16$, $p = .87$; 2 options: $t(69) = -0.52$, $p = .60$; 3 options: $t(69) = 0.20$, $p = .84$; 4 options: $t(69) = 0.07$, $p = .94$).

The significant analyses were followed-up with one-way analysis of variance (ANOVA) to determine what music condition(s) were driving the effects. For the early selections from Deck A, the ANOVA was not significant, $F(7,125) = 0.83$, $p = .56$. For the early selections from Deck C, the ANOVA was marginally significant, $F(7,125) = 1.94$, $p = .07$; however, no individual comparisons were significant (all $ps > .10$).

Discussion

The present study sought to expand upon the Evano (2013) study, which examined active and passive listening to rock and classical music and their effects on risky decision making tasks. The present study sought to eliminate the question of whether it was the presence of a rock music tempo or the presence of lyrics that explained previous findings of rock music impairing decision making. In the present study, the original Evano (2013) conditions were maintained (rock music, classical music, no music, working memory task), but added an instrumental version of the rock music songs, two mid-tempo music conditions (instrumental and lyrics), and a spoken-word podcast. The results found were contrary to prediction.

The first hypothesis tested was that listening to rock music would result in riskier decision making than listening to mid-tempo music. This hypothesis was based in part on the Evano (2013) finding that active listening to rock music resulted in riskier decision making on the IGT. However, in the present study, it was found that those listening to mid-tempo music made riskier decisions than those listening to rock music, and this occurred on the GDT but not

the IGT or BART. While these results seem to run counter to the previous study, rock music was being compared to classical music, which may represent a more extreme difference in music tempos than comparing the rock and mid-tempo music in the present study. However, the present findings run counter to other research that has shown music rhythm negatively affects attention and working memory (Berti & Schroger, 2003; Salame & Baddeley, 1989).

The second hypothesis investigated whether the presence of lyrics impaired decision making compared to the presence of instrumental music. There were no significant differences found between the groups on the BART or the GDT, but the lyrics group was found to make more advantageous decisions in the early IGT trials. Incidentally, Bechara et al. (1997) define the early trials of the IGT as the “pre-hunch” phase, wherein participants are not certain of the patterns of the cards yet and are deciding under hot, or affective, conditions. This result was opposite of the expectation and counter to previous research (Alley & Green, 2008; Pring & Walker, 1994). It is unclear why the presence of lyrics influenced decision making on the IGT during the ambiguous trials—when decision making under risk has not yet begun. It is possible that the lyrics interfered with participants’ natural response to the early trials—to select from decks with high immediate rewards—but this effect evened out (resulting in no differences) after learning occurred on the task.

The third hypothesis was that completion of a concurrent working memory task would result in riskier decision making than actively listening to music. This hypothesis was not supported. No significant differences were found on the GDT or the BART, but on the IGT, the working memory group chose significantly less cards from Deck A, a disadvantageous deck, and more cards from Deck C, an advantageous deck, during the early trials. This finding is inconsistent with previous research indicating impaired decision making while a dual task was

completed (Dromei & Shim, 2008; Starcke et al., 2011). It is unclear why this result occurred. Previous research suggests a strong correlation between working memory ability and performance on the IGT (Toplak et al., 2010), yet manipulating working memory capacity in a dual-task paradigm did not significantly impair performance (and in fact improved performance in the early trials only). However, recent research has suggested that true decision making under risk occurs on the later IGT trials only (Brand et al., 2007), in which no group differences were found in this study.

As previously mentioned, cold decision making relies on logical and analytical thought, whereas hot decision making relies more on emotions and intuition (Seguin et al., 2007). Although decision making is considered an executive function, correlations between measures of decision making and other executive tasks have been inconsistent (see Buelow & Suhr, 2009). The IGT, GDT, and BART are all considered measures of hot, affective decision making (Bechara et al., 1994; Brand et al., 2007; Lauriola et al., 2013), and it is possible that cold decision making processes may have been more interrupted by a dual task than hot decision making processes. In a state of distraction, it is conceivable one could perform better on emotion-based decision making tasks, where decisions do not require as much conscious deliberation. However, this does not account for the Evano (2013) findings, in which hot decision making was affected by a working memory manipulation. In addition, current theory suggests that there may be more overlap between hot and cold decision making processes than previously thought.

The use of only hot decision making tasks may have limited the present findings, and future research should utilize both hot and cold tasks together. A second possible limitation is the music used in the study. Few participants indicated familiarity with the Gershwin selections,

which could have affected the results. Future research could examine the effect of familiarity of different types of music on decision making, rather than music that may never have been heard before. That said, participants were also not as familiar with the classical music selections but did not indicate as much dislike for the classical music as was expressed for the mid-tempo music. However, male, female, and a child's voices appeared on the Gershwin selections, whereas only a single male voice appeared on the Metallica selections. Future research should use only one voice on any vocal music. We are also not certain that the instrumental and lyrical conditions were equally taxing of working memory resources. But, by far the largest limitation of the present study was the sample size. An a priori power analysis indicated a minimum of 30 participants per cell were required to obtain adequate power for the independent-samples *t*-tests. However, due to low participant sign-up rates and high numbers of participant no-shows to study sessions, the total sample size obtained was between 15 and 20 per group. With this low number of participants per group, it is likely that normality was not achieved and individual differences in performance could be swaying results in different directions.

In conclusion, this study was looking at the effect of music tempo and the presence of lyrics on decision making. Results ran counter to prediction, and provided some evidence that riskier decision making may occur in those listening to mid-tempo versus rock music, instrumental music versus music with lyrics, and listening to music versus completing a dual working memory task. Future research should examine the effect of lyrics and tempo differences on both hot and cold decision making processes, as well as the effect of more familiar music on performance. This study supports the notion that the connection between working memory and decision making is a truly complex relationship with many intricacies and nuances.

References

- Alley, T., & Greene, M. (2008). The relative and perceived impact of irrelevant speech, vocal music and non-vocal music on working memory. *Current Psychology*, 27, 277–289.
- Angel, L.A., Polzella, D.J., & Elvers, G.C. (2010). Background music and cognitive performance. *Perceptual and Motor Skills*, 110, 1059-1064.
- Baddeley, A. D., & Logie, R. H. (1999). Working memory: The multiple-component model. In A. Miyake, P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control* (pp. 28-61). New York, NY US: Cambridge University Press.
- Bechara, A. (2008). *Iowa gambling task professional manual*. Lutz: Psychological Assessment Resources.
- Bechara, A., Damasio, A.R., Damasio, H., & Anderson, S.W. (1994). Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition*, 50, 7-15.
- Bechara, A., Damasio, H., Tranel, D., & Damasio, A.R. (1997). Deciding advantageously before knowing the advantageous strategy. *Science*, 275, 1293–1295.
- Berti, S., & Schröger, E. (2003). Working memory controls involuntary attention switching: Evidence from an auditory distraction paradigm. *European Journal of Neuroscience*, 17(5), 1119-1122.
- Brand, M., Recknor, E.C., Grabenhorst, F., & Bechara, A. (2007). Decisions under ambiguity and decisions under risk: Correlations with executive functions and comparisons of two different gambling tasks with implicit and explicit rules. *Journal of Clinical and Experimental Neuropsychology*, 29, 86-99.

- Buelow, M. T., & Suhr, J. A. (2009). Construct validity of the Iowa gambling task. *Neuropsychology Review*, 19(1), 102-114.
- De Martino, B., Kumaran, O., Seymour, B., & Dolan, R. J. (2006). Frames, biases, and rational decision-making in the human brain. *Science*, 313(5787), 684-687.
- Dromey, C., & Shim, E. (2008). The effects of divided attention on speech motor, verbal fluency, and manual task performance. *Journal of Speech, Language, and Hearing Research*, 51, 1171-1182.
- Evano, C. (2013). The influence of music and working memory load on decision making. Unpublished undergraduate thesis.
- Fakhri, M., Sikaroodi, H., Maleki, F., Ghanaati, H., & Oghabian, M. (2013). Impacts of normal aging on different working memory tasks: Implications from an fMRI study. *Behavioural Neurology*, 27(3), 235-244.
- Figner, B., Mackinlay, R. J., Wilkening, F., & Weber, E. U. (2009). Affective and deliberative processes in risky choice: Age differences in risk taking in the Columbia card task. *Journal Of Experimental Psychology: Learning, Memory, And Cognition*, 35(3), 709-730.
- Hickok, G., Buchsbaum, B., Humphries, C., & Muftuler, T. (2003). Auditory–motor interaction revealed by fMRI: Speech, music, and working memory in area Spt. *Journal of Cognitive Neuroscience*, 15, 673– 682.
- Hunt, M.K., Hopko, D.R., Bare, R., Lejuez, C., & Robinson, E. (2005). Construct validity of the balloon analog risk task (BART): Associations with psychopathy and impulsivity. *Assessment*, 12, 416-428.

- Kennerley, S. W., Dahmubed, A. F., Lara, A. H., & Wallis, J. D. (2009). Neurons in the frontal lobe encode the value of multiple decision variables. *Journal of Cognitive Neuroscience*, 21(6), 1162-1178.
- Lauriola, M., Panno, A., Levin, I. P., & Lejuez, C. W. (2014). Individual differences in risky decision making: A meta-analysis of sensation seeking and impulsivity with the balloon analogue risk task. *Journal of Behavioral Decision Making*, 27(1), 20-36.
- Lejuez, C.W., Read, J.P., Kahler, C.W., Richards, J.B., Ramsey, S.E., Stuart, G.L., Strong, D.R., & Brown, R. A. (2002). Evaluation of a behavioral measure of risk-taking: The balloon analogue risk task (BART). *Journal of Experimental Psychology: Applied*, 6, 75-84.
- Lezak, M.D., Howieson, D.B., & Loring, D.W. (2004). *Neuropsychological assessment (fourth edition)*. Oxford: Oxford University Press.
- Olivers, C.N., & Nieuwenhuis, S. (2006). The beneficial effects of additional task load, positive affect, and instruction on the attentional blink. *Journal of Experimental Psychology: Human Perception and Performance*, 32, 364-379.
- Pecchinenda, A., Dretsch, M., & Chapman, P. (2006). Working memory involvement in emotion-based processes underlying choosing advantageously. *Experimental Psychology*, 53, 191-197.
- Pring, L., & Walker, J. (1994). The effects of unvocalized music on short-term memory. *Current Psychology*, 13, 165-171.
- Salamé, P., & Baddeley, A. (1989). Effects of background music on phonological short-term memory. *The Quarterly Journal of Experimental Psychology Section A*, 41, 107-122.

- Séguin, J. R., Arseneault, L., & Tremblay, R. E. (2007). The contribution of 'cool' and 'hot' components of decision-making in adolescence: Implications for developmental psychopathology. *Cognitive Development*, 22(4), 530-543.
- Silverman, M. (2010). The effect of pitch, rhythm, and familiarity on working memory and anxiety as measured by digit recall performance. *Journal of Music Therapy*, 47, 70-83.
- Starcke, K., Pawlikowski, M., Wolf, O., Altsötter-Gleich, C., & Brand, M. (2011). Decision-making under risk conditions is susceptible to interference by a secondary executive task. *Cognitive Process*, 12, 177-182.
- Toplak, M.E., Sorege, G.B., Benoit, A., West, R.F., & Stanovich, K.E. (2010). Decision-making and cognitive abilities: A review of associations between Iowa gambling task performance, executive functions, and intelligence. *Clinical Psychology Review*, 30, 562-581.
- Uncapher, M., & Rugg, M. (2005). Effects of divided attention on fMRI correlates of memory encoding. *Journal of Cognitive Neuroscience*, 17, 1923–1935.
- Uncapher, M., & Rugg, M. (2008). Fractionation of the component processes underlying successful episodic encoding: a combined fMRI and divided-attention study. *Journal of Cognitive Neuroscience*, 20, 240-254.
- Watson, D., Clark, L.A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063-1070.
- Wechsler, D. (2008). *Wechsler adult intelligence scale-fourth edition (WAIS-IV)*. San Antonio, TX: Pearson.
- Wilkinson, G.S., & Robertson, G.J. (2006). *Wide range achievement test 4*. Lutz, FL: PAR, Inc.

Table 1.*Study Variables Presented as Mean (Standard Deviation) for all Study Conditions*

Variable	Rock-I	Rock-L	Mid-tempo-I	Mid-tempo-L
<i>n</i>	20	20	20	15
Music Background	6/20	8/20	8/20	6/20
Gender	12 Males	1 Male	7 Male	5 Male
Age	19.43 (3.32)	19.00 (0.67)	18.45 (0.69)	19.00 (0.95)
WRAT-IV	57.21 (6.64)	59.11 (4.09)	58.20 (5.73)	57.93 (4.45)
DS-F	11.11 (2.66)	10.78 (2.24)	10.58 (2.27)	9.73 (1.39)
DS-B	7.58 (2.34)	7.33 (2.30)	7.58 (1.39)	7.07 (1.49)
DS-S	7.53 (1.68)	7.78 (2.07)	7.37 (1.30)	7.33 (1.72)
PANAS-P	3.09 (0.78)	2.66 (0.70)	2.89 (0.97)	3.13 (0.58)
PANAS-N	1.47 (0.42)	1.62 (0.68)	1.61 (0.72)	1.31 (0.34)
IGT A1	21.81 (8.22)	21.62 (5.31)	22.13 (5.27)	21.73 (5.53)
IGT B1	31.25 (11.86)	30.97 (13.40)	29.38 (7.82)	32.50 (5.20)
IGT C1	21.39 (5.89)	26.25 (11.25)	21.13 (5.03)	23.85 (5.06)
IGT D1	25.56 (12.41)	20.83 (8.70)	27.38 (8.98)	21.92 (5.60)

IGT A2	15.83 (7.74)	17.96 (5.19)	15.75 (7.92)	16.41 (7.32)
IGT B2	30.37 (17.08)	35.74 (12.53)	23.80 (12.85)	32.82 (13.11)
IGT C2	21.48 (11.27)	21.11 (8.02)	19.75 (8.03)	22.31 (8.26)
IGT D2	32.31 (22.44)	25.09 (14.85)	40.50 (19.50)	28.46 (18.49)
BART	27.95 (12.98)	34.89 (9.93)	33.07 (12.67)	26.49 (16.21)
GDT \$	-\$1,376.47 (\$2,315.31)	-\$2,422.22 (\$2,704.52)	-\$1,058.82 (\$2,524.40)	-\$2,585.71 (\$3,528.32)
GDT 1	3.53 (3.94)	3.67 (3.04)	3.41 (3.26)	5.21 (4.25)
GDT 2	5.24 (3.67)	4.33 (2.55)	3.00 (1.97)	3.21 (1.81)
GDT 3	3.06 (1.64)	3.00 (2.69)	4.82 (3.68)	3.36 (2.50)
GDT 4	6.18 (4.13)	7.00 (4.87)	6.76 (4.29)	6.21 (3.60)

Note: WRAT-IV = Wide Range Achievement Test Word Reading subtest; DS = Digit Span

Forwards (F), Backwards (B), and Sequencing (S); PANAS = Positive and Negative Affect

Schedule; IGT = Iowa Gambling Task, percent selections from each deck on early (1) and later

(2) trials; BART = Balloon Analogue Risk Task number of pumps per balloon; GDT = Game of

Dice Task, total money earned (\$) and number of selections from each risk level (1-4).

Table 1. Continued

Variable	Podcast	Classical	No Music	Working Memory
<i>N</i>	16	16	19	15
Music Background	9/16	9/16	9/19	10/15
Gender	6 Male	4 Male	7 Male	5 Male
Age	18.10 (0.32)	18.57 (0.79)	18.38 (0.62)	18.33 (0.50)
WRAT-IV	58.06 (6.84)	58.33 (8.78)	60.10 (4.30)	57.60 (3.12)
DS-F	11.50 (2.22)	10.25 (1.60)	11.30 (2.15)	9.93 (2.52)
DS-B	6.94 (2.29)	7.58 (2.02)	7.40 (2.37)	7.80 (1.42)
DS-S	7.56 (1.55)	7.17 (1.70)	8.10 (1.65)	8.00 (1.85)
PANAS-P	3.09 (0.75)	2.56 (0.57)	3.00 (0.89)	3.19 (0.81)
PANAS-N	1.53 (0.55)	1.48 (0.60)	1.54 (0.49)	1.22 (0.25)
IGT A1	20.18 (7.10)	21.41 (6.89)	20.00 (5.38)	17.50 (8.60)
IGT B1	31.07 (9.89)	37.34 (10.55)	33.13 (9.06)	30.00 (11.60)
IGT C1	27.14 (5.45)	21.88 (5.04)	22.00 (9.23)	30.54 (21.01)
IGT D1	21.61 (5.60)	19.38 (6.61)	24.88 (9.75)	21.96 (9.72)

IGT A2	20.60 (13.29)	15.83 (9.33)	14.17 (7.71)	13.10 (8.08)
IGT B2	31.79 (15.43)	36.46 (18.49)	28.67 (14.55)	28.93 (11.61)
IGT C2	25.83 (13.54)	23.75 (11.90)	26.25 (15.83)	26.31 (8.94)
IGT D2	21.55 (10.55)	23.96 (16.44)	30.92 (12.51)	31.67 (8.94)
BART	27.55 (14.39)	34.92 (14.08)	31.59 (8.09)	29.02 (16.14)
GDT \$	-\$2,625.00 (\$4,142.93)	-\$3,085.71 (\$3,512.56)	-\$2,600.00 (\$3,182.35)	-\$2,114.29 (\$3,948.18)
GDT 1	4.67 (5.50)	4.14 (3.48)	3.90 (3.65)	3.71 (4.57)
GDT 2	2.42 (2.27)	2.00 (1.41)	3.75 (3.02)	4.29 (2.98)
GDT 3	4.75 (3.65)	3.57 (2.70)	4.00 (1.95)	3.43 (1.51)
GDT 4	6.17 (3.90)	8.29 (3.15)	6.35 (4.52)	6.57 (4.96)

Table 2.*Means and Standard Deviations for Rock versus Mid-Tempo*

Variable	Rock		Mid-Tempo	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
IGT A1	21.97	5.29	21.71	6.82
IGT B1	30.61	6.99	31.11	12.47
IGT C1	22.20	5.14	23.82	9.19
IGT D1	25.23	8.18	23.19	10.83
IGT A2	16.01	7.58	16.90	6.58
IGT B2	27.35	13.51	33.06	15.01
IGT C2	20.76	8.09	21.30	9.65
IGT D2	35.76	19.74	28.70	19.11
BART	30.48	14.30	31.06	12.09
GDT \$	-\$1,748.39	\$3,064.30	-\$1,738.46	\$2,455.37
GDT 1	4.23	3.78	3.58	3.59
GDT 2	3.10	1.87	4.92	3.30
GDT 3	4.16	3.24	3.04	2.01
GDT 4	6.52	3.94	6.46	4.32

Note: IGT = Iowa Gambling Task, percent selections from each deck on early (1) and later (2) trials; BART = Balloon Analogue Risk Task number of pumps per balloon; GDT = Game of Dice Task, total money earned (\$) and number of selections from each risk level (1-4).

Table 3.*Means and Standard Deviations for Instrumental versus Music with Lyrics*

Variable	Instrumental		Lyrics	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
IGT A1	21.81	6.72	21.67	5.31
IGT B1	32.36	10.48	31.61	10.64
IGT C1	21.44	5.24	25.24	9.14
IGT D1	24.40	10.10	21.29	7.47
IGT A2	15.80	8.14	17.31	6.11
IGT B2	29.74	16.63	34.52	12.64
IGT C2	21.51	10.33	21.61	8.01
IGT D2	32.87	20.50	26.51	16.26
BART	31.70	13.29	31.25	13.46
GDT \$	-\$1,536.59	\$2,659.30	-\$2,521.74	\$3,165.86
GDT 1	3.59	3.51	4.61	3.82
GDT 2	3.76	2.99	3.65	2.14
GDT 3	3.88	2.87	3.22	2.52
GDT 4	6.78	4.03	6.52	4.05

Note: IGT = Iowa Gambling Task, percent selections from each deck on early (1) and later (2) trials; BART = Balloon Analogue Risk Task number of pumps per balloon; GDT = Game of Dice Task, total money earned (\$) and number of selections from each risk level (1-4).

Table 4.*Means and Standard Deviations for Working Memory and Music Groups*

Variable	Working Memory		Music	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
IGT A1	17.50	8.60	21.75	6.21
IGT B1	30.00	11.60	32.09	10.48
IGT C1	30.54	21.01	22.82	7.11
IGT D1	21.96	9.72	23.26	9.31
IGT A2	13.10	8.08	16.35	7.46
IGT B2	28.93	11.61	31.48	15.39
IGT C2	26.31	8.94	21.55	9.50
IGT D2	31.67	17.59	30.55	19.21
BART	29.02	16.14	31.55	13.27
GDT \$	-\$2,114.29	\$3,948.18	-\$1,890.63	\$2,866.54
GDT 1	3.71	4.57	3.95	3.63
GDT 2	4.29	2.98	3.72	2.70
GDT 3	3.43	1.51	3.64	2.75
GDT 4	6.57	4.96	6.69	4.01

Note: IGT = Iowa Gambling Task, percent selections from each deck on early (1) and later (2) trials; BART = Balloon Analogue Risk Task number of pumps per balloon; GDT = Game of Dice Task, total money earned (\$) and number of selections from each risk level (1-4).

Appendix A

Demographic and Background Information

1. Gender: Male _____ Female _____

2. Age: _____

3. Educational Level:

First year college _____	Fourth year college _____
Second year college _____	Fifth year college _____
Third year college _____	Other: _____

4. What is your approximate GPA?

Below 1.00 _____	2.50 – 2.99 _____
1.00 – 1.49 _____	3.00 – 3.49 _____
1.50 – 1.99 _____	3.50 or higher _____
2.00 – 2.49 _____	

5. Which best describes your ethnic background (check as many as needed):

Caucasian _____	Black/African-American _____
Hispanic _____	American Indian or Alaska Native _____
Asian or Pacific Islander _____	Other: _____

6. What is your parents' current marital status?

Married _____	Divorced _____
Separated _____	Cohabiting _____
Widowed _____	Other: _____

7. What was your family's average yearly income when you were in high school?

\$15,000 or less _____	\$65,001 - \$80,000 _____
\$15,001 – \$25,000 _____	\$80,001 - \$95,000 _____
\$25,001 - \$35,000 _____	\$95,001 - \$110,000 _____
\$35,001 - \$50,000 _____	\$110,001 - \$125,000 _____
\$50,001 - \$65,000 _____	Over \$125,000 _____

8. If you currently live with your family of origin (i.e., parents, grandparents), what was your family's approximate income last year?

\$15,000 or less _____	\$65,001 - \$80,000 _____
\$15,001 – \$25,000 _____	\$80,001 - \$95,000 _____
\$25,001 - \$35,000 _____	\$95,001 - \$110,000 _____
\$35,001 - \$50,000 _____	\$110,001 - \$125,000 _____
\$50,001 - \$65,000 _____	Over \$125,000 _____

9. If you live independently or with your own family, what was your approximate income last year?

\$15,000 or less	_____	\$65,001 - \$80,000	_____
\$15,001 - \$25,000	_____	\$80,001 - \$95,000	_____
\$25,001 - \$35,000	_____	\$95,001 - \$110,000	_____
\$35,001 - \$50,000	_____	\$110,001 - \$125,000	_____
\$50,001 - \$65,000	_____	Over \$125,000	_____

10. What is the highest level of education completed by your mother?

Less than 12 th grade	_____	Some graduate school	_____
High School graduate	_____	Master's Degree	_____
Some college	_____	Ph.D., JD, MD	_____
College graduate	_____	Other: _____	

11. What is the highest level of education completed by your father?

Less than 12 th grade	_____	Some graduate school	_____
High School graduate	_____	Master's Degree	_____
Some college	_____	Ph.D., JD, MD	_____
College graduate	_____	Other: _____	

12. Have you ever received a diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD) or Attention-Deficit Disorder (ADD)?

Yes _____

No _____

If Yes, subtype: Inattentive _____

Hyperactive _____

Combined _____

13. How old were you when you were diagnosed with ADHD or ADD? _____

14. Who diagnosed you with ADHD or ADD?

Physician (MD) _____

Psychologist (PhD) _____

Psychiatrist (MD) _____

School Counselor or Psychologist _____

Other (please specify): _____

15. What medications have you tried to treat ADHD/ADD (mark all that apply):

Adderall	_____	Ritalin	_____
Adderall-XR	_____	Ritalin-SR	_____
Concerta	_____	Ritalin-LA	_____
Dexedrine	_____	Strattera	_____
Dexedrine-XR	_____	Vyvanse	_____
Focalin	_____	Other (please specify):	
Focalin-XR	_____	_____	

16. What current medications are you taking to treat ADHD/ADD (mark all that apply):

Adderall	_____	Ritalin	_____
Adderall-XR	_____	Ritalin-SR	_____
Concerta	_____	Ritalin-LA	_____
Dexedrine	_____	Strattera	_____
Dexedrine-XR	_____	Vyvanse	_____
Focalin	_____	Other (please specify):	_____
Focalin-XR	_____		_____

17. If you are currently receiving medication to treat ADHD/ADD, when did you last take your medication? _____

18. Have you ever received a diagnosis of a Learning Disorder (LD), such as a Reading Disorder, Writing Disorder, or Math Disorder?

Yes _____
No _____

19. How old were you when you were diagnosed with an LD? _____

20. Have you ever received a psychiatric diagnosis, such as depression, anxiety, Bipolar Disorder, or Schizophrenia?

Yes _____
No _____

21. How old were you when you received a psychiatric diagnosis? _____

22. Are you currently, or have you in the past, received treatment for a psychiatric disorder?

Yes, currently _____
Yes, in the past _____
Yes, currently and in the past _____
No, never _____

23. Are you currently experiencing any sleep-related difficulties, such as:

Difficulty falling asleep _____
Difficulty staying asleep _____
Waking too early in the morning _____
Stopping breathing during sleep _____
Snoring _____

24. How many days per week, on average, do you experience sleep difficulty? _____

25. Have you ever been diagnosed with a Traumatic Brain Injury (TBI) or a head injury?

Yes _____
No _____

26. How many TBIs or head injuries have you experienced in your lifetime? _____

27. Have you ever lost consciousness after hitting your head?

Yes, only for a few seconds _____
 Yes, for less than 10 minutes _____
 Yes, for less than 1 hour _____
 Yes, for over 1 hour _____
 No _____

28. Were you ever hospitalized following a head injury?

Yes _____
 No _____

29. Have you ever undergone brain surgery following a head injury?

Yes _____
 No _____

30. Are you currently experiencing any cognitive (thinking) difficulties related to a head injury?

Yes _____
 How long ago was the injury? _____
 No _____

31. Have you ever experienced a concussion, such as while playing sports?

Yes _____
 No _____

32. How many concussions have you experienced in your lifetime? _____

33. Do you drink caffeinated beverages, such as caffeinated soft drinks, coffee, and tea?

Yes _____
 No _____

34. Do you consider yourself a regular caffeine drinker?

Yes _____
 No _____

35. During the past 30 days, on how many did you drink a caffeinated beverage? _____

36. How many caffeinated beverages do you drink per day, on average? _____

37. Do you consider yourself a regular or social cigarette smoker?

Social _____
 Regular _____
 Neither _____

38. How old were you when you smoked a whole cigarette for the first time? _____

39. During the past 30 days, on how many did you smoke cigarettes? _____

40. How many cigarettes do you smoke per day, on average? _____

41. Have you ever tried to quit smoking cigarettes?

Yes, and I do not smoke cigarettes now _____

Yes, but I returned to smoking cigarettes _____

Number of quit attempts: _____

No, I have never tried to quit smoking cigarettes _____

No, I have never smoked cigarettes _____

42. During the past 30 days, on how many days did you use chewing tobacco or snuff?

43. How old were you when you first starting using chewing tobacco? _____

44. Have you ever tried alcohol?

Yes _____

No _____

45. How old were you when you had your first drink of alcohol, other than a few sips?

46. Do you currently drink alcohol?

Yes _____

No _____

47. Do you consider yourself a regular or social user of alcohol?

Social _____

Regular _____

Neither _____

48. During the past 30 days, on how many days did you have at least one drink of alcohol?

49. During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row (i.e., within a couple of hours)? _____

50. Have you ever tried to quit drinking alcohol?

Yes, and I do not drink alcohol now _____

Yes, but I returned to drinking alcohol _____

Number of quit attempts: _____

No, I have never tried to quit drinking alcohol _____

No, I have never drank alcohol regularly _____

51. Have you ever tried marijuana?

Yes _____
No _____

52. How old were you when you first tried marijuana? _____

53. Do you consider yourself a regular or social user of marijuana?

Social _____
Regular _____
Neither _____

54. During the past 30 days, on how many days did you use marijuana? _____

55. When you used marijuana in the past 30 days, how much would you use per day?

56. Have you ever tried any form of cocaine, including powder, crack, or freebase?

Yes _____
No _____

57. How old were you when you first tried any form of cocaine? _____

58. Do you consider yourself a regular or social user of cocaine?

Social _____
Regular _____
Neither _____

59. During the past 30 days, how many times did you use any form of cocaine? _____

60. Do you currently use pain medications (such as codeine, Percocet, Oxycontin, morphine, etc.) without a doctor's prescription, OR do you take more of these medications than is prescribed?

Yes _____
No _____

61. During the past 30 days, on how many days did you use pain medications not following a doctor's prescription? _____

62. How many times in the past 30 days did you use inhalants (sniffing glue, breathing contents of aerosol cans, inhaling paints/sprays)? _____

63. How many times in the past 30 days did you use steroids without a doctor's prescription?

64. How many times in the past 30 days did you use other illegal substances, such as LSD, PCP, ecstasy, mushrooms, speed, ice, or heroin? _____

65. How many times in the past 30 days did you mix alcohol with other substances?

Appendix B

Music Background Questionnaire

1. Have you ever taken music lessons, either individually or in a group?
☐ Yes ☐ No ****If NO, please skip to Question #4.**

2. What type of instrument(s) were you instructed on, and when did you receive this training?

Instrument	Start	End
1.		
2.		
3.		
4.		
5.		

3. For each instrument from Question 2, please indicate how you learned to play that instrument from the following choices: By ear, Music class, Private lessons, Group lessons, From a parent/friend, Online
 Instrument 1:
 Instrument 2:
 Instrument 3:
 Instrument 4:
 Instrument 5:

4. What type of instrument(s) do you currently play?

5. If you currently play an instrument, how often (per week) do you play?

6. How long have you played the instrument(s) indicated in Question 3?
☐ Less than 6 months
☐ 7 months to 2 years
☐ 2 years to 5 years
☐ 5 years to 10 years
☐ Over 10 years

7. For the instrument from Question 3, please indicate how you learned to play that instrument from the following choices:
 By ear, Music class, Private lessons, Group lessons, From a parent/friend, Online

8. Have you ever received vocal lessons?

_____ Yes _____ No

****If NO, please skip to Question #11**

9. When did you receive vocal training?

Start End

10. If you currently are in vocal training, how often (per week) do you practice?

11. What is your background in music theory?

- _____ No training in music theory
- _____ Basic/elementary training in music theory
- _____ Moderate/intermediate training in music theory
- _____ Advanced training in music theory

12. What is your background in music composition?

- _____ No training in music composition
- _____ Basic/elementary training in music composition
- _____ Moderate/intermediate training in music composition
- _____ Advanced training in music composition

13. If you were asked to compose a piece of music, could you (mark all that apply):

- _____ Create the staff
- _____ Indicate the measure
- _____ Write down a few notes
- _____ Write a complete song
- _____ Write variations on the song in different keys
- _____ Write the complete song with variations in tempo and rhythm

14. How often do you listen to music (i.e., radio, satellite radio, internet streaming, iPod/MP3 player, iTunes, etc.)?

- _____ Never
- _____ Rarely (Less than one day per week)
- _____ Sometimes (2-3 days per week)
- _____ Most of the time (4-5 days per week)
- _____ Often (6-7 days per week)

15. What type of music do you typically listen to. Please rank the following options from 1 (most often listened to) to 17 (least often listened to):

- _____ Alternative
- _____ Blues
- _____ Classical
- _____ Country
- _____ Electronic/Techno
- _____ Folk
- _____ Hip Hop
- _____ Jazz
- _____ Latin
- _____ Musical Theater
- _____ Pop
- _____ R&B
- _____ Rap
- _____ Reggae
- _____ Religious
- _____ Rock
- _____ World
- _____ Other (please indicate): _____

16. How do you typically listen to music? Check all that apply.

- _____ Dance to music
- _____ Listen to music while exercising
- _____ Listen to before a sporting event
- _____ Listen to while studying
- _____ Listen to while driving
- _____ Listen to while completing chores/household tasks
- _____ Listen to before going to sleep
- _____ Other (please indicate): _____

17. When you listen to music, do you typically focus on:

- _____ The lyrics
- _____ The music/beat/rhythm
- _____ Both the lyrics and the music/beat/rhythm

18. What are your five favorite bands/musicians:

1:

2:

3:

4:

5:

18. How familiar are you with the lyrics to the songs from your favorite bands/musicians listed in Question 17?

Band/Musician #1: _____

- _____ Know none of the lyrics to the songs
 _____ Know some of the lyrics to the songs
 _____ Know most of the lyrics to the songs
 _____ Know all of the lyrics to the songs

Band/Musician #2: _____

- _____ Know none of the lyrics to the songs
 _____ Know some of the lyrics to the songs
 _____ Know most of the lyrics to the songs
 _____ Know all of the lyrics to the songs

Band/Musician #3: _____

- _____ Know none of the lyrics to the songs
 _____ Know some of the lyrics to the songs
 _____ Know most of the lyrics to the songs
 _____ Know all of the lyrics to the songs

Band/Musician #4: _____

- _____ Know none of the lyrics to the songs
 _____ Know some of the lyrics to the songs
 _____ Know most of the lyrics to the songs
 _____ Know all of the lyrics to the songs

Band/Musician #5: _____

- _____ Know none of the lyrics to the songs
 _____ Know some of the lyrics to the songs
 _____ Know most of the lyrics to the songs
 _____ Know all of the lyrics to the songs

19. Do you have plans to pursue music in the future, such as (check all that apply):

- ☐ Start a band
- ☐ Join a band
- ☐ Participate in musical theater
- ☐ Start music lessons
- ☐ Continue music lessons
- ☐ Perform for the public
- ☐ Perform for friends
- ☐ Major in music

Appendix C

Positive and Negative Affect Schedule

Directions: This scale consists of a number of words that describe different feelings and emotions. Read each item and then circle the appropriate answer next to the word. Indicate to what extent you feel this way **right now**.

	<u>Very Slightly</u>	<u>A Little</u>	<u>Moderately</u>	<u>Quite a Bit</u>	<u>Extremely</u>
1. Interested	1	2	3	4	5
2. Distressed	1	2	3	4	5
3. Excited	1	2	3	4	5
4. Upset	1	2	3	4	5
5. Strong	1	2	3	4	5
6. Guilty	1	2	3	4	5
7. Scared	1	2	3	4	5
8. Hostile	1	2	3	4	5
9. Enthusiastic	1	2	3	4	5
10. Proud	1	2	3	4	5
11. Irritable	1	2	3	4	5
12. Alert	1	2	3	4	5
13. Ashamed	1	2	3	4	5
14. Inspired	1	2	3	4	5
15. Nervous	1	2	3	4	5
16. Determined	1	2	3	4	5
17. Attentive	1	2	3	4	5
18. Jittery	1	2	3	4	5
19. Active	1	2	3	4	5
20. Afraid	1	2	3	4	5